

DECIDUAL REACTIONS IN FALLOPIAN TUBES
HISTOLOGIC STUDY OF TUBAL SEGMENTS FROM 144 POST-PARTUM
STERILIZATIONS *

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This report is based upon histologic examination of excised tubal segments from 144 consecutive post-partum sterilizations done at the Kapiolani Maternity and Gynecological Hospital during the 3-year period from 1940 to 1942 inclusive. It was prompted by the frequent observation, during the past 2 years, of a decidual reaction in such tubal segments. Consequently, all tubes removed at post-partum sterilizations during 1942 have been studied more carefully than is the usual custom with such specimens. In most cases sections were prepared at intervals through each tubal segment and in a number of instances complete serial sections were made. In addition, all sections of post-partum tubes removed during the preceding 2-year period were reviewed, although in most of these cases only one microscopic section through each tubal segment was available for examination. The tubal segments varied in length from 1 to 2 cm. and in all but 2 cases comprised the proximal (isthmian) portions.

One or both tubal segments from 17 (12 per cent) of these 144 cases exhibited decidual formation of varying extent and location. These cases are analyzed in Table I.

One-half of the patients making up this group of 144 cases were Hawaiian or part Hawaiian in nationality. The majority of the remainder were Japanese, Chinese, and Filipinas, and there were relatively few Caucasians. Eleven (64 per cent) of the 17 cases showing a tubal decidual reaction belonged to the Hawaiian or part Hawaiian group and there were only 3 Caucasians (2 of them Portuguese) in the remaining 6. The significance of this finding will be considered later.

The elapsed time in hours between delivery and operation varied from 0 (cesarean section) to 65. There was no constant correlation between the length of time between delivery and operation and the presence of decidual tissue or the amount of decidual cell involution.

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TABLE I
Analysis of 17 Post-partum Sterilizations in which Decidual Change was Found in the Excised Tubal Segments

Case no.	Race	Age	Para	Hours post-partum	Number of sections studied	Location of decidua	Amount of decidua	Involution	Serosal mesothelium
1	Pt. Hwn.	28	4	28	Serial	Mucosal and serosal	Great	Advanced	Cuboidal
2	Cauc.	26	5	20	1	Mucosal	Slight	Slight	Flat
3	Pt. Hwn.	26	4	60	4	Mucosal and serosal	Slight	Slight	Cuboidal
4	Pt. Hwn.	28	3	0	1	Serosal	Slight	None	Flat
5	Hwn.	24	4	47	1	Mucosal	Slight	None	Flat
6	Hwn.	33	7	44	1	Mucosal	Moderate	Moderate	Flat
7	Cauc.	30	2	57	2	Mucosal	Moderate	Moderate	Cuboidal to columnar
8	Hwn.	33	4	12	Serial	Mucosal	Great	Slight	Cuboidal
9	Cauc.	30	2	0	1	Serosal	Slight	None	Cuboidal
10	Pt. Hwn.	25	4	58	1	Mucosal	Slight	Advanced	Flat
11	Pt. Hwn.	27	4	32	1	Mucosal	Moderate	Slight	Flat
12	Pt. Hwn.	34	2	0	Serial	Mucosal	Slight	None	Cuboidal
13	Jap.	38	6	8	1	Serosal	Moderate	Moderate	Cuboidal
14	Jap.	38	2	27	Serial	Mucosal	Great	Advanced	Cuboidal
15	Pt. Hwn.	25	4	20	1	Serosal	Slight	Moderate	Cuboidal to columnar
16	Jap.	28	4	65	100 μ apart	Serosal	Moderate	Moderate	Cuboidal with invaginations
17	Hwn.	32	10	21	100 μ apart	Mucosal and serosal	Moderate	Slight	Cuboidal

Hwn. = Hawaiian

Pt. Hwn. = Part Hawaiian

Jap. = Japanese

Cauc. = Caucasian (including Portuguese)

LOCATION OF DECIDUA

In 9 cases the decidual tissue occupied the mucosal folds, in 5 it was subserosal in location and in the remaining 3 it was found in both locations. The involved mucosal folds were swollen and distended by the decidual cells, and the covering tubal epithelium was, without exception, greatly flattened but always recognizable as a distinct layer (Figs. 2 and 4). The tips or free margins of the rugae showed the greatest change; toward the bases of the folds decidual cells were rarely found. Where the process was extensive the rugae appeared as pedunculated spherical masses attached to the wall by narrow pedicles (Fig. 1). Where involution was slight the decidual cells were well preserved structurally and presented the characteristic mosaic pattern seen in the endometrium (Fig. 4). The cells, however, tended to vary somewhat in size and shape and many of them were elongated and spindle-shaped.

The serosal decidua in general was less well developed than that in the mucosa, and there was even greater variation in the size and shape of the cells. In only one instance (case 1) was there a continuous mantle of cells surrounding the tube. In the remaining cases the cells existed in the form of small accumulations just beneath the mesothelium. The patches of decidua were most numerous in the region of the mesosalpinx and often existed in the form of small evaginations covered by flat serosal mesothelium (Fig. 5).

AMOUNT OF DECIDUA

In cases 1, 8 and 14 the decidual tissue was abundant, practically all of the mucosal folds in both segments showing this change, and serial sections in these 3 cases showed the decidual tissue to extend longitudinally throughout the entire length of the tubal segment (Fig. 1). In 6 cases the decidual formation was moderate in amount (less than one-half of the mucosal folds involved; two to four patches of decidua just beneath the mesothelium in those with serosal involvement). In 8 cases only slight decidual change was present. These exhibited from one or two cells up to one or two groups of cells either in the tip of a mucosal fold or in a patch beneath the serosa (Fig. 3).

DECIDUAL CELL INVOLUTION

In 9 cases there was no, or at most very slight, decidual cell involution; moderate or advanced involution was present in the remaining 8. Study of the latter group of cases yielded interesting data on decidual cell involution. The initial stage in this process is

the appearance of a large round vacuole in the center of the cell with displacement of the nucleus toward the periphery (Fig. 5). This is followed by additional large vacuoles resulting in complete disappearance of the cytoplasm and further peripheral displacement of the nucleus. At this stage the cell is large and appears as a ring form not unlike the signet ring cell of mucoid adenocarcinoma (Fig. 6). The nucleus is elongated or band-like and is located far to the periphery at one margin of the cell. The nucleus then disappears and the cell shrinks and becomes irregular, forming a faintly staining small tear-drop or crescent-shaped structure which soon vanishes.

The end result of this process is the formation of a cyst or cysts at the decidual cell site. As each cell involutes it leaves behind the space which it formerly occupied. Thus in those cases showing involution, the decidual cells were loosely arranged, each separated from its fellow by a clear space, and the remaining cells were in various stages of the degenerative process already outlined (Fig. 2). In several locations this process was so extreme that the bulbous mucosal fold had been largely converted into a cyst in which only a few decidual cell remnants could be identified. A sprinkling of lymphocytes was usually present in the involuting areas.

SEROSAL MESOTHELIUM

In 11 of the 17 cases the serosal mesothelium was hyperplastic in nature and cuboidal to columnar in appearance. The cells had undergone peculiar rounded swelling due to increase in the cytoplasm (Figs. 5 and 7). The nuclei were round or oval and were located centrally. In 1 case invaginations into the underlying tissue were observed. Serosal hyperplasia was also found in many of the cases which failed to exhibit decidual tissue. The serosal mesothelium over the patches of decidua could usually be recognized as an intact and separate layer although it was greatly flattened in these locations (Fig. 5).

HISTORICAL ASPECTS

It has long been known that decidual reactions occur in many locations remote from the uterus. Novak¹ mentioned that such reactions have been described on the surface of the uterus, the anterior surface of the rectum, the floor of the cul-de-sac, the omentum, the ovary, the appendix, the cervix, the vagina and the peritoneum of the small intestine. Weller,² in 1935, reviewed the literature on this subject and discussed the significance of the ectopic decidual reaction in endometriosis. He stated that ectopic decidua on the pelvic peri-

toneum was first described by Walker³ in 1887 and the observation was soon confirmed by other workers. It is interesting to note that eleven of Weller's twelve references to the subject are in the German literature.

Ectopic decidual formation probably occurs more often than is generally appreciated. For example, Williams⁴ found ectopic decidual tissue in every fourth or fifth uterus removed at operation or autopsy at the end of pregnancy, an incidence of 20 to 25 per cent. Similarly, Hofbauer⁵ demonstrated ectopic decidua on the posterior aspect of the pregnant uterus in 15 of 23 specimens examined.

The ability of the tube to undergo decidual reaction was for many years a matter of controversy but it is generally recognized at the present time that such reactions do occur. Most authors agree that the tubal decidual reaction is slight in amount and patchy in location, approaching in no way the extensive decidual membrane formed in the uterus. The great majority of observations have been in connection with tubal pregnancy, particularly in reference to decidual formation at the implantation site. Williams⁴ stated that "occasionally, in uterine pregnancy, decidual cells may develop in the stroma of the tubal mucosa, but they never lead to the formation of a continuous membrane as in the uterus. Such observations are of extreme rarity but I have made them in several instances."

Kline⁶ studied 74 cases of extra-uterine pregnancy and presented evidence indicating that a decidual reaction of greater or less extent occurred constantly at the site of implantation. However, he observed a distant decidual reaction in the tube in only 3 of 51 cases examined. Kline thought that the decidua at the implantation site involuted rapidly with degeneration of the chorionic villi, whereas distant decidua in the tubes, uterus, or elsewhere sometimes persisted after degeneration of the trophoblast and complete involution of the local decidua. The observations in the present series of cases would seem to confirm this statement.

According to Frankel and Schenck,⁷ decidual tissue was described in tubal pregnancy by Webster⁸ in 1897. These authors further stated that Osiakina and Schmatok,⁹ in 1933, found a decidual reaction in the tube in 21 per cent of a series of 21 tubal pregnancies independent of the localization of the implanted ovum.

Geist and Matus¹⁰ stated: "It also seems likely that decidua is much more common in the tube than has been hitherto believed and that study of sufficient material may demonstrate this." These workers found decidual tissue most often in the connective tissue septa of the villi and believed that it "persisted for a much longer period of time

[than uterine decidua] because the involutionary process in the tube at this depth is decidedly slower than in the uterus."

Although a complete historical review was not possible, no report similar to the present one was found. In general there appears to have been surprisingly little written on the subject of ectopic decidual reactions.

DISCUSSION

The demonstration of decidual tissue in 12 per cent of 144 tubes removed post-partum is of theoretic importance in the etiology of tubal pregnancy. It is generally taught that the most important etiologic factors are mechanical ones. This study indicates that unusual receptivity of the tubal mucosa to the fertilized ovum may play a more important rôle than is generally believed. This idea has been advanced particularly by Frankel and Schenck,⁷ who believe that ectopic pregnancy results from implantation of the fertilized ovum on a receptive nidus of aberrant endometrium in the tubal mucosa or elsewhere. They believe that such a nidus of uterine mucosa is a prerequisite for the implantation and development of the ovum in a site remote from the uterus. This theory has much to recommend it but, as yet, proof is lacking. In not a single instance in the present study was aberrant uterine mucosa found. The extensive formation of decidua encountered in at least 3 of our cases suggests, nevertheless, that receptivity of the tubal mucosa may be an important factor in the causation of tubal gestation, entirely apart from the presence of actual uterine mucosa.

This statement is of particular significance in view of the high incidence of ectopic gestations in Hawaii. Schattenburg¹¹ has recently investigated this question. He found that during the 5-year period from 1936 to 1940 inclusive there were 4,964 deliveries and 75 ectopic pregnancies at The Queen's Hospital. The total number of tubal pregnancies thus comprised 1.5 per cent of the deliveries, a much higher figure than the ones usually given. For example, Schumann¹² stated that 1 in every 303 pregnancies is extra-uterine, an incidence of only 0.303 per cent. Salpingitis, considered to be one of the chief predisposing factors in the causation of ectopic gestation, is relatively infrequent in Hawaii. Perhaps this is a reflection of the exceptionally low venereal disease rate which exists here.¹³ May not the high incidence of ectopic gestations in Hawaii result from unusual hormonal "responsiveness" of the tubal mucosa, perhaps due to local climatic or racial factors? The present report suggests this since 11 of the 17 patients evincing a tubal decidual reaction were Hawaiians or

part Hawaiians and there were only 3 Caucasians in the remaining 6.

Be that as it may, a knowledge of the various stages in the involution of ectopic decidual cells is of practical importance to the pathologist. Interpretation is difficult when the peculiar ring forms associated with this process are observed for the first time. The degenerative process, when present, was identical in both the mucosal and serosal decidua and we have likewise found it in 3 of 5 cases of endometriosis associated with pregnancy. - It may also be observed in uterine decidua, although the changes are not so well defined since the factor of inflammation is almost invariably present. Hofbauer,⁵ in his excellent paper published in 1929, noted the variation in size and shape of ectopic decidual cells and observed that vacuoles in the cytoplasm were common. We feel sure that cytoplasmic vacuolization is an initial stage in decidual cell involution.

The decidual cells arise from mesenchymal cells in the stroma of the folds and from similar cells beneath the serosal mesothelium. This process was described by Hofbauer⁵ who believed that such multipotent mesenchymal cells could give rise, not only to decidual cells, but also to unstriated muscle fibers. There was not the slightest suggestion in any of our cases that the decidual cells were derived from the tubal epithelium; the latter was always flattened by pressure. It is equally unlikely that the cells of the serosal mesothelium ever give rise to decidua. The serosal mesothelium could usually be recognized as a distinct although greatly flattened layer over the patches of decidua; elsewhere it was often hyperplastic and appeared cuboidal, even columnar, in cross section.

SUMMARY

Decidual tissue was demonstrated in one or both tubal segments from 17 of 144 post-partum sterilizations, an incidence of 12 per cent.

In 9 cases the mucosal folds were involved, in 5 there were patches of decidua beneath the serosa, and in 3 decidua was present in both locations.

The decidual tissue varied in amount from one or two cells in the tip of a mucosal fold in 2 cases to masses of cells in all of the mucosal folds in 3. Serial sections in the latter 3 cases showed the decidual tissue to extend longitudinally the entire length of the tubal segment.

In 8 of the 17 cases decidual cell involution of varying degree was present. This process is characterized by vacuolization of the cytoplasm and flattening and peripheral displacement of the nucleus. The cytoplasm then disappears entirely, resulting in peculiar irregular ring forms somewhat resembling the signet ring cells of mucoid ad-

enocarcinoma. The final stage is represented by faintly staining, small, irregular shadow or ghost forms.

The decidual cells arise from mesenchymal cells in the stroma of the folds and from similar cells beneath the serosa. The tubal epithelium over the areas of decidual tissue formation is greatly flattened by pressure; elsewhere it is normal. The serosal mesothelium covering the patches of serosal decidua is similarly flattened; in other locations it is often hyperplastic, appearing cuboidal or even columnar in nature.

CONCLUSIONS

1. This study indicates that decidual reactions in fallopian tubes may occur more often than is generally believed.
2. The fact that 67 per cent of the patients showing a tubal decidual reaction were Hawaiians or part Hawaiians, together with our inability to find a similar report in the literature, suggests, however, that the phenomenon may be a purely local one, perhaps dependent upon racial or climatic factors.
3. It is further suggested that it may have an etiologic bearing upon the high incidence of ectopic gestation in Hawaii.

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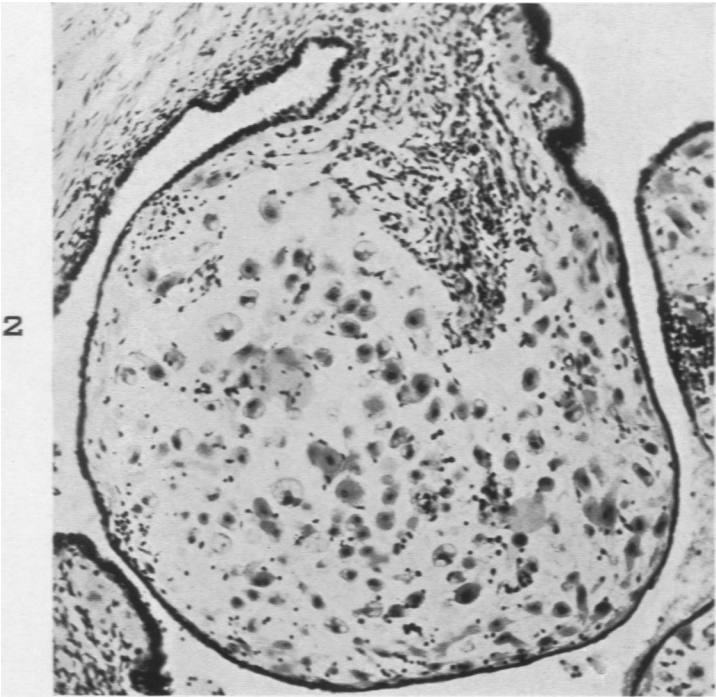
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[*Illustrations follow*]

DESCRIPTION OF PLATES

PLATE 126

- FIG. 1.** Case 1. Every mucosal fold is distended by decidual cells. Advanced involution is present, leaving most of the folds partially cystic. Hematoxylin and eosin stain. $\times 40$.
- FIG. 2.** Case 1. A distended mucosal fold attached to the wall by a relatively narrow pedicle. The tubal epithelium is flattened by compression. Extensive involution is present, leaving the fold partially cystic. The remaining decidual cells are in various stages of degeneration and vacuolated cells and ring forms are evident. Hematoxylin and eosin stain. $\times 130$.
- FIG. 3.** Case 5. Two structurally intact decidual cells are present in the tip of a mucosal fold. The covering epithelium is flattened. Hematoxylin and eosin stain. $\times 300$.

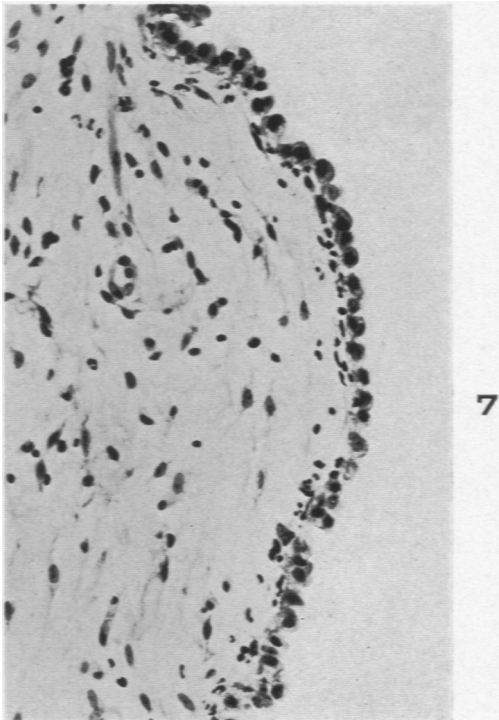
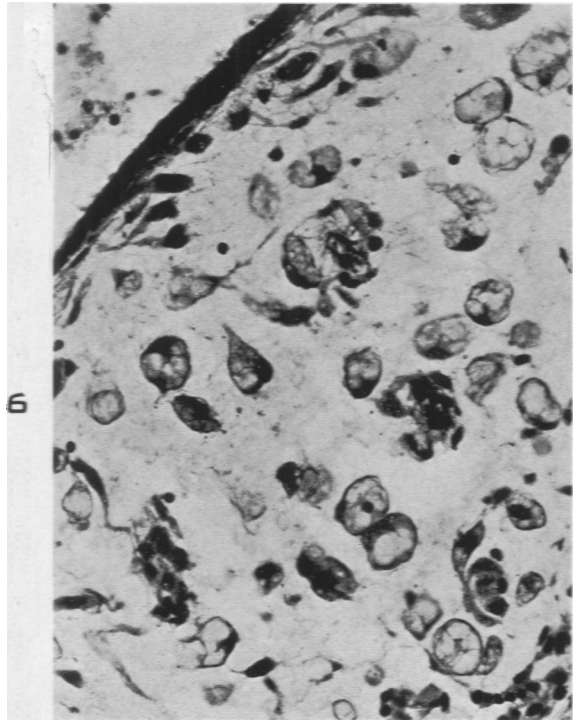
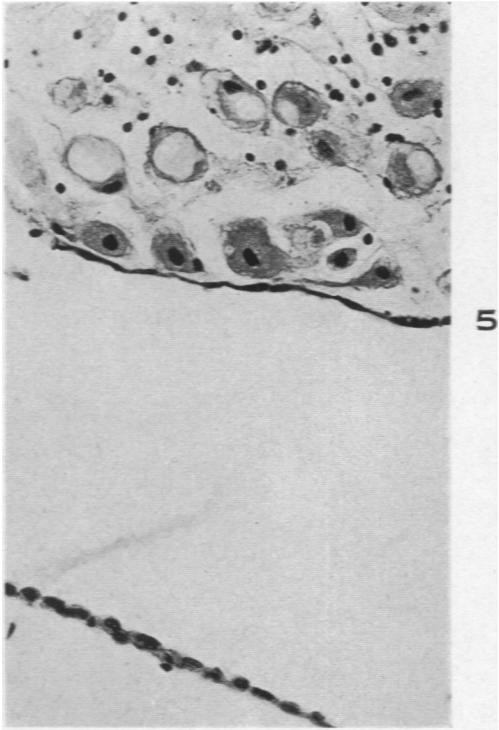
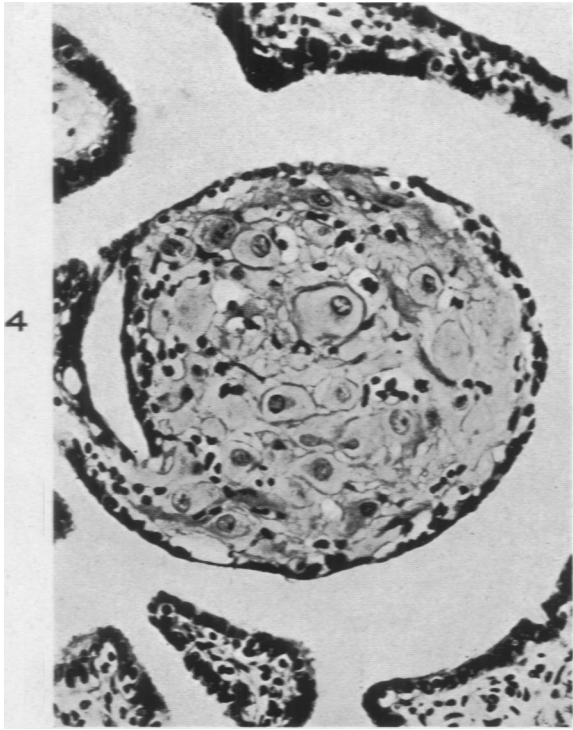


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PLATE 127

- FIG. 4. Case 8. A mucosal fold distended by a mass of structurally well preserved decidual cells. The cells vary somewhat in size and shape and the covering tubal epithelium is flattened. Hematoxylin and eosin stain. $\times 300$.
- FIG. 5. Case 16. A group of decidual cells in a peritoneal evagination near the mesosalpinx. Here are seen vacuolated cells, ring forms and an intact but greatly flattened covering layer of serosal mesothelium. The structure below is cuboidal mesothelium which has become detached from the underlying tissue. Hematoxylin and eosin stain. $\times 300$.
- FIG. 6. Case 1. Involuting decidual cells. Most of them exist as peculiar, somewhat irregular ring forms. Hematoxylin and eosin stain. $\times 300$.
- FIG. 7. Case 12. The serosal mesothelium is cuboidal in appearance, the cells rounded due to cytoplasmic increase, and the nuclei are located centrally. No decidual cells are present. Hematoxylin and eosin stain. $\times 300$.



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